MONITORING PLAN FOR REESTABLISHMENT OF THE NORTHERN APLOMADO FALCON *(Falco femoralis septentrionalis)* IN NEW MEXICO AND ARIZONA

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Introduction

The goal of the northern aplomado falcon (*Falco femoralis septentrionalis*) (falcon) reintroduction effort in New Mexico is to reestablish successfully breeding falcons in suitable habitat of the Chihuahua desert grasslands in New Mexico and Arizona in order to produce a falcon population that is not dependent on continued releases. Falcons are predicted to persist as a self-sustaining population or as subpopulations in the largest, unfragmented portions of their historic range. Details of the reintroduction effort can be found in the Final Rule and Environmental Assessment for Reestablishment of the Endangered Northern Aplomado Falcon into New Mexico and Arizona, which are available from the above address, or from the U.S. Fish and Wildlife Service (Service) Web site at http://www.fws.gov/ifw2es/NewMexico/.

We will reintroduce falcons in New Mexico under section 10(j) of the Endangered Species Act (Act). Implementation of this action requires that the Service periodically review and evaluate the reintroduction program. This monitoring plan will assist the Service in our program review of restoration efforts. The plan has two purposes: 1) To assist the Service in our evaluation of the release program as described in the proposed rule and environmental assessment, and 2) to provide guidelines for continued large-scale monitoring efforts in New Mexico and Arizona. A Federal agency may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid Office of Management and Budget control number.

Monitoring requirements and recommendations are described in two tiers. Tier 1 short-term monitoring includes basic monitoring requirements for newly released birds and for nesting falcons beginning three years after their reintroduction. The Peregrine Fund will be responsible for implementing Tier 1 monitoring, described below under "Releases" and "Post-release." The Peregrine Fund will submit annual reports on their falcon release monitoring results to the Service. The Bureau of Land Management's New Mexico State Office (BLM New Mexico) and U.S. Army Fort Bliss will be responsible for remote-sensing habitat data monitoring relevant to the reintroduction program. Tier 2 monitoring described below includes nonmandatory monitoring efforts subject to available funding. Annual stakeholder meetings will be conducted to review project data to determine if refinements to the program are needed. The Service will use the best scientific and commercial data available, including, but not limited to, results from the monitoring plan and stakeholder meetings to develop interim objectives to assist in measuring the success of the program and to prepare 5-year evaluations of the restoration program.

Tier I: Short-term Monitoring

Releases. The Peregrine Fund will select hack sites based on, but not limited to, the extent and proximity to other suitable habitat, potential threats from predators, prey availability, and logistics. Suitable habitat for release sites may therefore be different from the suitable nesting habitat ultimately selected by the falcons. Monitoring at the hack site will be conducted by The Peregrine Fund employees. Information gathered at each hack site will include field notes detailing behavior, predator interactions, and the number and identity of falcons reaching independence 21 days after release. In addition, an assessment of the release site using the attached habitat assessment sheet (Attachment A, which is Appendix C of Young *et al*. 2005)

will be completed, and four digital photos will be taken from the hack site, one in each cardinal direction, immediately prior to and after the release effort. Although release sites are not selected based on habitat characteristics alone, through time, habitat data from release sites may increase our understanding of factors affecting falcon releases and habitat use and may lead to improvement in release site selection. Landowner consent is a prerequisite for data collection on private land.

Post-release. In order to ascertain the success of the release effort, The Peregrine Fund will annually survey the area surrounding releases to locate surviving birds. Post-release monitoring will not be required until the third year after releases begin because falcons do not normally breed until they are two years of age.

Falcons will be located and identified and the number of territorial pairs will be recorded. If nesting is documented, then nest success will be assessed and as many chicks will be banded as possible. A habitat assessment sheet (Attachment A) will be completed by The Peregrine Fund to evaluate the surrounding area. Blood may be taken from individuals for laboratory studies. All released falcons and their progeny will be banded to the extent possible. The Peregrine Fund will coordinate with the Service to develop a banding plan that complements banding efforts in Mexico and Texas.

The BLM New Mexico and U.S. Army Fort Bliss biologists will gather remote-sensing digital raster data for nest sites and territories (greenness index and deviation from greenness) from the Internet during the breeding season when nesting occurs, beginning approximately 3 years after releases begin. This data will provide an assessment of vegetative growth conditions that may be compared to nesting success.

Tier II: Long Term Monitoring and Investigations

Long-term Monitoring. Under Tier II, in conjunction with surveys to help the Service assess the release effort, long-term monitoring and surveys for falcons in suitable habitat in New Mexico and Arizona should continue where applicable, and should also be conducted in areas that have not been previously or recently surveyed. When possible, the Interim Survey Methodology for the Northern Aplomado Falcon in Desert Grasslands (see U.S. Fish and Wildlife Service 2003) should be used; however, established road survey techniques for raptor species may also be sufficient. Biologists from The Peregrine Fund, Turner Endangered Species Fund, BLM New Mexico, Department of Defense, New Mexico Department of Game and Fish, Arizona Game and Fish Department, and the Service will be responsible for long-term monitoring and surveying. Attachments A and/or B should be completed when appropriate. In the future, if it becomes necessary to collect this information from 10 or more respondents per year, the Service will first obtain approval from the Office of Management and Budget.

Data collected for long-term monitoring and surveys should at minimum include all raptors and ravens observed. In addition, the Service recommends counting and identifying all avian species at these survey points, similar to the Breeding Bird Surveys, as this can provide information on avian prey availability for falcons. This information on other avian species will be of particular value when collected during the time the falcons form pair bonds and breeding territories. For documentation of the full complement of avian species within the survey area, all auditory and

visual detections should be recorded as in the Breeding Bird Survey protocol. We recommend including general vegetation and habitat descriptions of the area, emphasizing relative grass cover height and types and the spacing of prominent woody vegetation.

Documentation of stick nests will assist in the assessment of habitat suitability. All raptor and raven large stick nests located in the course of the survey should be tallied and their location marked with a Global Positioning System unit. Data collected for each nest site should include nesting activity and species identification if active. All suspected falcon nests should be viewed from a sufficient distance that precludes disturbing falcons near the nest site.

Survey areas should consider historical or potential occurrence of falcons and/or the existence of potential habitat within the area. Survey routes should be delineated in a manner that provides a complete survey of all potential habitats within the area. Routes will vary in number and length, depending on size of the area and amount of potential habitat to be surveyed. If the potential habitat area is large, multiple routes will need to be designated within the area for adequate coverage. The survey area, habitat types, survey routes, and observation points should all be documented on USGS 7.5 minute maps and can also be submitted using GIS mapping. Although falcons may inhabit their range year-round, they will be most conspicuous from February 1 through August 31, which spans their periods for courtship, nesting, and the post-fledging season (Keddy-Hector 2000, U.S. Fish and Wildlife Service 1990, Montoya *et al*. 1997). Therefore, to maximize the likelihood of detecting falcons, surveys are best conducted during this period.

Weather and time constraints are necessary to ensure that surveys are conducted when detections are not reduced by wind, precipitation, or temperature. Therefore, surveys should be conducted in the mornings from sunrise to 4 hours after sunrise. Weather information should be recorded on the survey data form at the beginning of the survey. Any changes in the weather should be noted during the course of the survey. Supplemental surveys may be conducted in the evenings from 4 hours before sunset to sunset. Surveys should only be conducted when there is no precipitation or sustained wind speeds of $\leq$ 16 kilometers per hour ($\leq$ 10 miles per hour).

Investigations. Tier II investigations will include any research other than that required under Tier I. These may include, for example, studies regarding the biology of the falcons or their ecological requirements. Tier II investigations are not mandatory and will be funded independently of Tier I activities. It may also be necessary to contact the appropriate State agency regarding their permitting requirements for certain activities, such as handling falcons. Biologists from The Peregrine Fund, Turner Endangered Species Fund, BLM New Mexico, Department of Defense, New Mexico and Arizona State Game and Fish Departments, and the Service will be responsible for performing the investigations.

Reporting

The Peregrine Fund will provide an annual report to the Service by February 1 of each year detailing the previous year's release efforts. At the time of the 5-year evaluation, The Peregrine Fund will provide the Service with a cumulative progress report detailing release efforts and

breeding success within the project area. In addition, the BLM New Mexico and U.S. Army Fort Bliss will submit a remote-sensing habitat report to the Service annually.

The Peregrine Fund, the Turner Endangered Species Fund, BLM New Mexico, Department of Defense, New Mexico Department of Game and Fish, and Arizona Game and Fish Department will provide Tier II investigation and monitoring results via a report to the Service every two years, or at the completion of any individual study. Survey results should include: (1) Maps of surveyed areas, (2) completed survey data forms, (3) a narrative of the results and any observations of interest (i.e., other species of interest, notes on habitat suitability, nest availability), (4) photographs documenting falcons and/or habitat, and (5) shape files compatible with our geographic information system.

Data Sharing

A data-sharing agreement is under development to aid in management for the falcons. Data appropriate to management, such as nest locations, will be shared among the Service, The Peregrine Fund, BLM, the Department of Defense, New Mexico and Arizona State Game and Fish Departments, and the Turner Endangered Species Fund.

Paperwork Reduction Act

Office of Management and Budget (OMB) regulations at 5 CFR 1320, which implement provisions of the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*) require that Federal agencies obtain approval from OMB before collecting information from the public. A Federal agency may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. OMB approval is required if information will be collected from 10 or more persons (5 CFR 1320.3). "Ten or more persons" refers to the persons to whom a collection of information is addressed by the agency within any 12-month period, and to any independent entities to which the initial addressee may reasonably be expected to transmit the collection of information during that period, including independent State, territorial, Tribal, or local entities and separately incorporated subsidiaries or affiliates. For the purposes of this definition, "persons" does not include employees of the respondent acting within the scope of their employment, contractors engaged by a respondent for the purpose of complying with the collection of information, or current employees of the Federal government when acting within the scope of their employment, but it does include former Federal employees. The monitoring plan for reestablishment of the falcon contains a requirement for information collection; however, it does not affect 10 or more persons. Therefore, OMB approval and a control number are not needed for the data collection forms appended to the monitoring plan. In the future, if it becomes necessary to collect this information from 10 or more respondents per year, we will first obtain approval from OMB.

Literature Cited

Keddy-Hector, D.P. 2000. Aplomado Falcon (*Falco femoralis*). *In* The Birds of North America: Life Histories for the 21st Century, No. 549. A. Poole and F. Gills, eds., Philadelphia, Pennsylvania. 20 pp.

Montoya, A.B., P.J. Zwank, and M. Cardenas. 1997. Breeding biology of the aplomado falcon in desert grasslands of Chihuahua, Mexico. Journal of Field Ornithology, 68(1):135-143.

U.S. Fish and Wildlife Service. 1990. Northern Aplomado Falcon Recovery Plan. Albuquerque, New Mexico. 56 pp.

U.S. Fish and Wildlife Service. 2003. Interim Survey Methodology for the Northern Aplomado Falcon (*Falco femoralis septentrionalis)* in Desert Grasslands. Albuquerque, New Mexico. 16 pp,.

Young, K.E., B.C. Thompson, R. Valdez, W.R. Gould, and A. Lafón Terrazas. 2005. Assessment of predictive values from the aplomado falcon habitat suitability model: Validation information for conservation planning in the northern Chihuahuan Desert. New Mexico Cooperative Fish and Wildlife Research Unit. Las Cruces, New Mexico. 63 pp. + appendices.

APLOMADO FALCON HABITAT SUITABILITY ASSESSMENT PROTOCOL WORKSHEET (Version 1.3).

Adapted from Young et al. 2005 - Appendix C

Falcon ID:_____ Point ID:_____ Date _____General Location:_____

Observers: _____ _____ UTM E: _____ UTM N:_____ Zone _____
Datum_____

Photo #_____ azimuth_____ Aplomado falcon present Y N
Photo #_____ azimuth_____ Documented aplomado falcon use area Y N
Photo #_____ azimuth_____ Size of assessment area
Photo #_____ azimuth_____ Photo UTM E _____ UTM N _____

Process	Action/ Decision

Level 1 If an aplomado falcon is detected during assessment visit or it is a known aplomado falcon use area complete the entire form through Level 3.

1) Substantial grassland (see definition in Attachment C) present in assessment area (area should be >2.5km²)
1.0= Yes
0= No

2) Relief appears flat to gently rolling, < 5 degree (10%) slope in assessment area
1.0= Yes
0= No

Subtotal Score _____ **If subtotal score is < 2, discontinue assessing**

Level 2

1) Topography in assessment area
1.0= Swale/basin, flat valley bottom
0.7= Gently sloped bajada, gently rolling upland
0.5= Mesa top, steeper bajada
0.2= Rolling, Irregular, hilly (e.g. foothills)
0= Steep hillside, hilltop — (reevaluate slope requirement in Level 1)

2) Land cover within assessment area
1.0= Grassland appears homogenous (uniform or varying species composition and cover), or grassland has clumps/aggregates (not highly interspersed) of woody structure
0.5= Grassland at distinct edge of woody structure
0.3= Grassland with highly interspersed woody vegetation
0= Primarily shrubland with interspersed grassland

3) Raptor perch substrates present (>0.5 m tall) or woody vegetation species associated with aplomado falcons
1.0= Yucca & Ephedra, or Yucca & others
0.8= Yucca only
0.5= Arborescent Mesquite, Rhus or similar species
0.2= Others only (including power, telephone poles, or fence posts)
0= No

4) Evidence of anthropogenic disturbance/fragmentation within assessment area
1.0= Little or no disturbance (e.g., two-track)
0.5= Moderate disturbance/human activity (e.g., maintained road, single building)
0.2= Obvious fragmentation and/or disturbance (e.g., regular human activity, oil, or gas developments)
0= Serious anthropogenic conversion (e.g., plowed fields, severe grazing, or multiple activities)
– reevaluate grassland requirement in Level 1.

5) Alteration of grassland system (e.g., changes in species composition or dominance, shrub encroachment, or soil erosion)

1.0= Little or none

0.5= Some to moderate (e.g., minor erosion, obvious presence of "increaser" grass species)

0= Substantial (e.g., severe shrub encroachment, severe erosion -coppice dunes, gullying)

Subtotal Score _____ **If subtotal score is <2.7, discontinue assessing**

Level 2 comments:

Level 3 Measure criteria 1-4 in the grassland portion only of the assessment area.

1) Grass basal cover (grassland area only) in assessment area Ocular est. _____ Quantitative _____

1.0=> 15 %

0.8=10-14%

0.5=5-9%

0=0-4%

2) Grassland species composition (grassland area only) in primarily Ocular est. _____ Quantitative _____

1.0= Grama and/or tobosa grassland

0.9= Mixed grassland (variety of grassland species present)

0.5= *Sporobolus* (dropseed, sacaton) grassland

0= Other

3) Woody vegetation density (shrubs >0.5 m tall/ha) (grassland area only) Ocular est. _____ Quantitative _____

1.0=< 300 plants/ha

0.5=300 - 600 plants/ha

0=> 600 plants/ha

4) Woody vegetation species presence (shrubs >1.5 m tall) that may support nest structure in assessment area.

1.0= Yucca (Soaptree or Torrey Ocular est. _____ Quantitative _____

0.5= Arborescent Mesquite/Rhus or similar tree

0= Other

5) Number of available raptor or raven nests Ocular est. _____ Quantitative _____

1.0=> 2 in assessment area

0.8=1-2 in assessment area (maximum if ocularly estimated)

0.5= None in assessment area, but > 1 within 800m of assessment area

0= None in assessment area, and none within 800m of assessment area.

Subtotal Score _____

If subtotal score is between 2 to 3.5 for ocular estimates, quantitative evaluation may be necessary to conclude habitat potential.

If subtotal score is > 2.5 , the area is considered potential habitat. Further detailed habitat evaluation such as prey availability may be considered necessary.

Level 3 comments:

Diagram of assessment area

Attachment B of Monitoring Plan

APLOMADO FALCON SURVEY DATA FORM

Survey Route Description:

County:_____ USGS Quad Name(s):

Survey Location: UTM Coordinates _____E _____N Elevation:_____ Lat/Long Coordinates T__ R__ Sec(s)

Survey Date:_ _._ _ _._ _ Survey Time: Start_____End

Day Month Year

Weather: Wind Speed (max)____ Temperature (max) ____ Cloudcover %

Primary Observer:_____ Other Observer(s):

Survey mode: Vehicle___ Walk___

Individual Species Observed by Station:

TUVU BLVU GOEA BAEA MIKI BSKI NOHA SSHA COHA NOGO
BWHA RTHA SWHA RLHA FEHA WTHA HAHA ZTHA OSPR **APFA**
CRCA AMKE MERL PRFA PEFA CORA CHRA AMCR LOSH

* = Large stick nest present. ✦=unlikely, needs verification

Notes_____

_____

_____

Directions To Complete The Aplomado Falcon Habitat Suitability Assessment Protocol Worksheet (Version 1.3)

Worksheet (Version 1.3) Adapted from Young et al. 2005 - Appendix D.

Site assessments and vegetation measurements can be conducted by anyone. However, all individuals that perform site assessments should be familiar with aplomado falcon ecology and habitat. Familiarity with aplomado falcon habitat can be obtained by reading the literature, viewing photographs of habitat, and attending training sessions. There are various sources to obtain this information. Perhaps the most comprehensive review of aplomado falcon ecology is presented in the Birds of North America: Life Histories for the 21st Century (Keddy-Hector 2000). Further, information pertaining directly to aplomado falcon ecology in the Chihuahuan Desert can be found in Young et al. (2002). This report can be downloaded at the New Mexico Cooperative Fish and Wildlife Research Unit (NMCFWRU) web address provided at the end of this document. Photos of falcon nest and detection sites in northern Chihuahua are also available on the NMCFWRU web address and should be reviewed periodically. To reduce variability among field biologists, all individuals should consult with others who have been trained in the use of the assessment protocol.

Assessment Protocol Purpose

Predicting aplomado falcon presence in an area is not possible. Therefore, the primary aim of this protocol is to provide an impartial approach to evaluate landscapes in terms of their potential to be aplomado falcon habitat. This assessment was developed as a tool to validate the Habitat Suitability Model produced by Young et al. (2002). However, the assessment protocol can be used in absence of the suitability model. The Habitat Suitability Model evaluates potential aplomado falcon habitat based on landscape, spectral configuration and composition. These features are not visible on the landscape. Conversely, the assessment protocol evaluates features that are visible on the landscape. The criteria in the assessment protocol are derived from landscape features identified by the Habitat Suitability Model analyses and from on the ground habitat measurements focused at sites occupied by aplomado falcons in northern Chihuahua, Mexico. The outcome of the assessment protocol can be translated as potential habitat/not-potential habitat, or in grades of habitat suitability ranging from not suitable to highly suitable habitat. Additional uses of the protocol include:

- Identify areas where management can be used to effectively create or reclaim aplomado falcon habitat.
- Identify habitat suitability of particular sites where proposed actions may affect habitat quality. The assessment can be used in predicting potential deleterious effects of human activities.
- Characterize areas according to habitat suitability so monitoring can be utilized to detect changing conditions at sites.

Protocol for Habitat Suitability Assessment

The assessment is conducted at three levels, beginning with a purely qualitative approach to a more specific quantitative evaluation at Level 3. General criteria in Levels 1 and 2 are used to quickly rule out obviously unsuitable habitat. In addition to simply scoring the sites, additional comments, descriptions of site characteristics, diagrams and photographs (four photographs, one per cardinal direction) are all useful information to include with the assessment form. Areas with unsuitable habitat conditions where management practices can improve habitat should be identified and considered for future actions, especially in areas with very little habitat. During the assessment, observers should scan the area for aplomado falcons. If an aplomado falcon is detected during a site visit, the procedure should continue through all levels of the assessment (unless of course disturbance to the bird would occur, in which case the assessment can be done at a later date). Observers should record UTM coordinates (with their associated zone and datum). This will aid in relocating the site for future assessments.

Important Considerations in the Assessment Approach

The assessment should be applied to the largest possible area for the situation and multiple evaluation points are recommended. However, the protocol is designed to evaluate areas as small as 2.5 km2. In large areas, multiple categories may exist. In these cases, either multiple assessment points may be needed or assessors should select the category present in the area with the highest score. In considering habitat at a smaller scale, habitat components may not be present within the site, but on a broader level, the habitat features may be present. For example, a particular grassland may be lacking in nest site availability. However, if potential nesting sites are present in an adjacent shrubland within approximately 800m, the grassland and adjacent 800m of shrubland may be potential falcon habitat. Use a "heads up" approach when examining the landscape and judging criteria. Use a vertical perspective in assessing vegetation types and ground cover. Assess landscape features in the criteria as it relates to the falcon's behavior. For example, in assessing land cover, consider the significance of shrub cover as potential hindrance to falcon hunting. Employ a flexible approach to the protocol in Level 1 so as not to eliminate an area that might pass Level 2 as habitat. If there is uncertainty in a criterion in the first level, it will be better to use the more specific criteria in Level 2 to determine the suitability of the habitat. Level 3 is useful in rating habitat quality and identifying specific components of aplomado falcon habitat.

Level 1 Assessment

The evaluation entails a qualitative assessment of a site's likely ability to be falcon habitat based on landscape features. It can be conducted in the field or via GIS information depending on site familiarity and/or available ancillary data showing the site conditions. Features considered include the presence of substantive grassland and appropriate physiographic relief.

Substantial Grassland
At Level 1 the definitions of "substantive" and "grasslands" should be flexible to avoid eliminating an area that may pass Level 3. An area may be considered grassland if grass cover is greater than shrub cover. Thus, areas with dense shrubs may still be classified as grassland.

Substantial grassland may be concluded if the grassland portion of the assessment area comprises a minimum of 15-20% of a 2.5 km^2 area. This translates into a grassland area of approximately 400-450m x 400-450 m within 2.5 km^2 assessment area.

Relief
Relief may be coded as acceptable if the general slope of land is < 5 degrees (approximately 10%) or areas with small rolling hills with some slopes > 5 degrees, but the majority of slopes are < 5 degrees. This translates to an average of < 10 m change in elevation over a 100m area, or < 70 m change in elevation over a 800m area.

Level 2 Assessment

Level 2 evaluates features associated with aplomado falcon nest and detection sites in northern Chihuahua, and features associated with grassland integrity. Level 2 requires a site visit where criteria are assessed qualitatively. Again, when features appear to be on the border of two answers, higher scoring should be applied to avoid elimination of potential habitat. Site characteristics pertaining to topography, vegetation characteristics, and human disturbance are assessed.

Topography in Assessment Area
Topography in this category is related to slope and soil productivity. Swales and basins tend to have deep productive soils, while steep hillsides tend to be shallow or rocky soils. Often, swales and basins have greater availability of nest substrates and nests, and a larger suite of avian potential prey. Relatively flat topography further enhances hunting for aplomado falcons. If the assessment area is flat such as a valley bottom or is gently sloping depression in the land surface (swale) topography, the area should score a 1.0. A bajada is a broad, gently inclined, alluvial piedmont slope that extends from the base of a mountain range to a basin and is formed by the merging of alluvial fans. A mesa top is a broad, flattop, erosional hill or mountain which is commonly bounded by steeper slopes. In many assessment areas, multiple topography categories may be present. In these cases, topographic scoring should be given to feature that represents the majority of the assessment area. Further, in large assessment areas, multiple assessment points will be needed.

Land Cover
The degree of grassland connectivity or heterogeneity within the assessment site is important. As aplomado falcons are overwhelmingly associated with grassland dominated communities, areas of primarily grass cover may allow falcons to shift territories relative to changes in the area. Grassland dominated communities may also attract migrating and wintering grassland birds (when environmental-climatic conditions are adequate). Categories that describe grassland connectivity or heterogeneity range from a pure homogenous grassland site to a primarily shrubland site with some grassland. A grassland is considered homogenous if it appears to have uniform species composition and cover (e.g., tobosa swales). Homogeneous grasslands may have various grass species and cover (different grass species in different areas and/or small open spaces) and may have some clumps of woody vegetation. A grassland with an occasional tree, or clumps of ephedra or stringers of soaptree yucca are examples. This is contrasted with grasslands that have woody vegetation more interspersed and have greater woody vegetation

density. In some cases, an open grassland may have a distinct edge of woody structure. This occasionally occurs at edges of tobosa swales with adjacent creosote bush communities, or with riparian vegetation. Land cover that is represented by primarily shrubland with interspersed grassland is essentially the opposite of grassland with lightly interspersed woody structure. These features may still have some potential for aplomado falcons, yet likelihood is not as high as above categories.

Raptor Perch Substrates Presence/Associated Woody Vegetation Species
The raptor perch substrate or associated woody vegetation species variable accounts for the presence of structures that may support perching activity and accounts for woody vegetation species associated with falcon sites in northern Chihuahua. The amount of substrates is not important. However, only substrates > 0.5 m tall are considered, with the exception of ephedra. In many areas of the Chihuahuan Desert, ephedra does not exceed 0.5 m tall.

Evidence of Anthropogenic Disturbance
There are few data to support a tolerance level to anthropogenic conversion by aplomado falcons. However, as the severity of landscape change increases, ecological conditions naturally become less suitable for aplomado falcons. The important factors to consider here are conversion, fragmentation, and human activity. Falcons have been found close to roads and single or sparse buildings, which are considered moderate anthropogenic conversions. Further, low density or intensity of oil and gas development or areas with regular human activity are considered moderate anthropogenic disturbance. However, urban areas, plowed agriculture fields, areas with severe grazing, have a long-term effect on conversion and fragmentation of the landscape, and thus are considered serious anthropogenic conversions. If the conversion is extreme to the extent that it eliminates any potential for birds to inhabit the area, then a substantial grassland (Level 1) may not exist.

Alteration of Grassland System
Apparent degradation of plant community involves a qualitative appraisal of the degree to which natural composition and function remain. The alteration of the grassland system may or may not relate to anthropogenic factors. Attributes to note when that lead towards some to moderate alteration include pedestaled plants or rocks, exposed plant roots, rills, and the presence of increaser grass species. Attributes of substantial alteration include severe shrub encroachment, coppice dunes, gullies, and deposition areas.

Level 3 Assessment

Level 3 is a quantitative assessment of the site's potential for aplomado falcons. Quantitative assessment of Level 3 can be time consuming which may reduce the amount of sites that could be assessed during a short time frame. The assessment form provides an option for qualitative assessment of variables in Level 3. However, if qualitative assessments are conducted in Level 3, quantitative assessments may still be needed to conclude habitat potential (see assessment form). If qualitative estimates are preformed, then qualitative/quantitative methods that give a rapid grass cover estimates and graphical depictions of canopy cover classes should be used. These methods should still be consider qualitative, but should result in more robust

estimates than purely qualitative estimates. Level 3 examines the grassland area within the assessment area in greater detail. Vegetation community features are estimated and compared to similar attributes described at aplomado falcon sites in northern Chihuahua. No one quantitative method is provided or recommended to estimate Level 3 variables. This was because often an assessment area will be a mosaic of grassland, shrubland, and bare ground. Further, different sized assessment areas may require different estimation procedures. For example, large areas may require air photos to estimate grass/shrub cover or density, whereas small areas may require ground estimates taken from transects. However, methods should be standardized for equal sized assessment areas. Further, methods used should be noted on the assessment form to aid in repeated assessments of the same area.

Grass Basal Cover

Grass basal cover should be estimated for only the grassland area inside of the assessment area. For small assessment areas (around 2.5 km^2), qualitative/quantitative estimates of basal cover can be estimated using the step-point method. Between 100-500 points should be collected in representative areas of the grassland. Because the number of points will vary by field biologist and grassland area, and because this method has inherent amount of variability associated with estimates, this method should be considered to be qualitative. However, since the goal was to estimate grass basal cover into 4 classes (see assessment form), and the scores associated with adjacent classes are similar, the qualitative nature of this variable may not greatly influence the assessment outcome.

Grass Species Composition

Grass species composition should be estimated only in the grassland area of the assessment area. Quantitative estimates of this variable should occur from points along transects. However, qualitative estimates can be based on a visual estimate of the dominant grass(s) in the grassland. Identification of grass species to the species level is not required, because species composition is grouped into 4 classes comprised primarily of grass genera (see assessment form). However, field biologists should be trained on plant identification to the species level. If there were several dominant grass species, then the area should be considered a mixed grassland. Grama and/or tobosa grasslands and mixed grasslands are scored higher than *Sporobolus* grasslands based on data collected at falcon sites in northern Chihuahua (Young et al. 2002).

Woody Vegetation Density

Woody vegetation density should be estimated for only the grassland area of the assessment area. Quantitative estimates are preferred. In small assessment areas, belt transects can be employed and tend to provide fairly quick quantitative estimates. Woody vegetation estimates are placed into 3 broad classes (see assessment form). Classes are based on data collected at falcon sites in northern Chihuahua. Qualitative/quantitative estimates of woody vegetation density can be facilitated by estimating the distance between plants. If a uniform distribution is assumed, then plant densities < 300 plants/ha are equal to 1 plant every 6 m or more (20 ft or more). Likewise, plant densities between 300-600 plants/ha is equal to 1 plant between 3 - 6 m (10 - 20 ft) and plant densities > 600 plants/ha are equal to 1 plant every 3 m or less (10 ft or less). Since plant communities rarely fit a uniform distribution, it is important to average plant distances across the grassland area. This method also has an inherent amount of variability associated with the estimates, and thus should still be considered a qualitative estimate. However, since density

estimates are placed into 3 broad classes, the qualitative nature of this variable may not greatly influenced the assessment outcome.

Woody Vegetation Species Presence
Conversely, woody vegetation species presence that may support a nest structure should be estimated over the entire assessment area. This variable accounts for the presence of woody species that may support a raptor or raven nest. Observers need to determine which species of tall shrubs (> 1.5 m) that may support a nest exist in the assessment area. This may or may not require a systematic search of the assessment area depending on the visibility of the area, and the observer's familiarity in identifying yucca species and other arborescent vegetation. Quantitative estimates for this variable are probably not necessary, since numbers of shrubs/trees in the assessment area are not evaluated with this variable.

Number of Available Nests
Likewise, the number of available nests should be estimated quantitatively. The scoring of this variable may increase the likelihood of an area passing as suitable habitat. Further, the absence of this variable may limit nesting habitat. The number of nests with a minimum of 20 cm bowl length and width should be tallied in the assessment area. The 20 cm bowl length and width was the smallest raptor or raven nest measured at falcon nest sites or random sites in northern Chihuahua. However, the bowl length and width dimensions are given primarily to allow observers a means to distinguish between raptor or raven nests and passerine nests. Because suitable nests are not always located in foraging habitat (grasslands), when no nests are located in the assessment area, nests should be tallied within 800 m of the assessment boundary. Although the assessment protocol allows users to assume the presence of at least some nest substrates presence, complete searches for nests are strongly encouraged.

Habitat Suitability Categories Based on Assessment Scores

A site may be considered 'high suitable habitat' if it passed Level 3 subtotal score. Sites that passed Level 2, but do not pass Level 3 may be considered 'moderate suitable habitat.' Sites that passed Level 1, but do not pass Level 2 may be considered 'low suitable habitat.' Sites that do not pass Level 1 may be considered 'not suitable habitat.' Sites can be evaluated based on assessment total scores. The assessment total score is calculated as the sum of the subtotals for Level 1, Level 2 and Level 3. However, Level 2 subtotals may exceed 2.7 (threshold needed to evaluate Level 3). If a site scores high in Level 2 but low in Level 3, the resulting total score value will not reflect the overall ranking of the site. Therefore, in total score calculations, Level 2 subtotals should be restricted to < 2.7. This will allow Level 2 qualitative assessment scores to not out-weigh Level 3 quantitative assessment scores in total score calculations. Total score values may be used in trend analysis or comparing between different sites.

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